

Amendment and Response
U.S. Serial No. 10/608,809
Filed: June 27, 2003
Attorney Docket No: 210-609INT

AMENDMENTS TO THE DRAWINGS

The Examiner has pointed out that the numeral 44 appears in Fig. 15 without being described in the Specification. Applicants respectfully request permission to amend Fig. 15 so as to omit numerals 44 therefrom.

Applicants append hereto a copy of Fig. 15 with two instances of numeral 44 circled in red, and further submit herewith an amended Fig. 15 lacking numerals 44.

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REMARKS

Claims 37-48 were presented in the original application. New claims 49-59 have been amended into the application at the suggestion of Examiner Spitzer. Upon entry of the new claims, six (6) independent claims and twenty-three (23) total claims will be pending in the application. Since the filing fee already paid covers three (3) independent claims and twenty (20) total claims, additional fees for three (3) additional independent claims and three (3) excess total claims are due, and a check for the payment of such fees is submitted herewith.

Claims 38, 39, 42, 43, 46, and 47 were rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. In particular, the Office action states that the specification does not contain any support for these limitations, in that there is no specific mention of either the hydrocarbon polymer comprising "at least one arylvinyl monomer" or that such monomer "is at least partially sulfonated."

Claims 37, 40, 41, 44, 45, and 48 were rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 4,449,992 to Yamada et al. (hereinafter "Yamada").

Claims 38, 39, 42, 43, 46, and 47 were rejected under 35 U.S.C. §103(a) as being unpatentable over Yamada in view of U.S. Patent No. 5,620,500 to Fukui et al. (hereinafter "Fukui").

Paragraphs [0012], [0013], [0035], [0036], [0040], [0041], [0042], [0045], [0048], [0050], [0053], [0054], [0056], and [0057] have been amended to correct informalities as cited by the Examiner. No new matter is introduced by the amendments.

Applicants present herewith a new paragraph [0041A] to be amended into the Specification after paragraph [0041] and before paragraph [0042]. The specification as originally filed includes an explicit reference in paragraph [0041] to a material called DAIS-585: "Moreover, an example of a commercially available sulfonated polymer membrane having a hydrocarbon backbone chemical structure includes the polymer membrane manufactured by the Dais Corporation, of Odessa, Fla., and distributed under the product

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name DAIS 585." At the time the present application was filed, there was included a two page document published in Design News on June 22, 1998, entitled "New membranes boost PEM performance," was obtained by downloading from the web site www.manufacturing.net/dn/index.asp?layout=articleWebzine&articleid=CA118013. A second copy is appended hereto for the convenience of the Examiner. The article discusses Proton Exchange Membranes (PEM) for fuel cell applications, and does not teach or suggest their use in air conditioning applications. The June 22, 1998 article describes the Dais 585 material as follows:

Recently, work by engineers at Rensselaer Polytechnic Institute (Troy, NY) under grant from Dais Corporation, has resulted in a new membrane material that exhibits the desirable properties of high conductivity and relatively low cost. It's called Dais 585 ionomer, and the core material is a sulfonated styrene/ethylene-butylene/styrene tri-block copolymer, a family which includes such familiar products as Shell Chemical's Kraton(copyright) elastomer.

In another publicly available document comprising 71 pages, entitled "High Temperature Membranes for Solid Polymer Fuel Cells," by Martin Hogarth and Xavier Glipa (hereinafter "Hogarth") there is further description of DAIS 585 material. Applicants attach hereto a copy of each of the cover page, pages 42 and 43, and page 65 of Hogarth, where there is pertinent disclosure. An entire copy of Hogarth, in either electronic format or in paper format, can be provided if the Examiner wishes to receive the complete document. At page 42, section A4.4.3, entitled "Sulfonated styrene/ethylene-butadiene/styrene triblock copolymer based membranes," there is an identification of the DAIS 585 material as a sulfonated Kraton polymer. Hogarth states that "[t]he structure of the sulfonated polymer [239, 240, 241] is shown in Fig. 29. This membrane is under development by Dais Company (USA)." Figure 29 appears at page 43 of Hogarth, and is presented hereinbelow, with the caption from Hogarth.

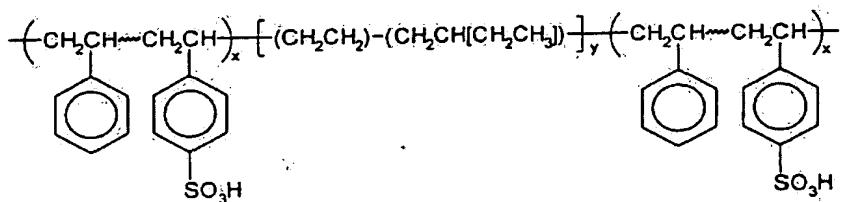


Figure 29. Structure of sulfonated styrene/ethylene-butadiene/styrene triblock polymer [239].

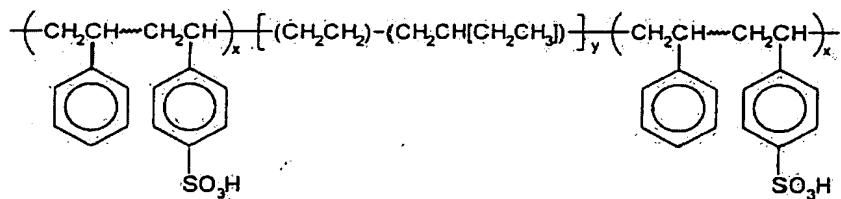
Furthermore, Hogarth at page 65 gives as references the following three citations, published in the 1995 to 1997 time period, although Hogarth itself was first published in 2001:

239. S.G. Ehrenberg, J.M. Serpico, B.M. Sheikh-Ali, T.N. Tangredi, E. Zador, G.E. Wnek, in *Proceedings of the Second International Symposium on New Materials for Fuel Cell and Modern Battery Systems*, (O. Savadogo, P.R. Roberge, eds.), Montréal, Canada, July 6-10, 1997, p.828.
240. S.G. Ehrenberg, J.M. Serpico, G.E. Wnek, J.N. Rider, U.S. Patent 5,468,574 (1995).
241. G.E. Wnek, J.N. Rider, J.M. Serpico, A.G. Einset, S.G. Ehrenberg, L. Raboin, in *Proceedings of the First International Symposium on Proton Conducting Membrane Fuel Cells*, The Electrochemical Society Proceedings, (S. Gottesfeld, G. Halpert, A. Landgrebe, eds.), Vol. 95-23 (1995), p. 247.

Clearly, the material referred to as DAIS 585 in the present application has been described in the public literature in sufficient detail that there should be little or no question as to the chemical species that it comprises. Therefore, Applicants respectfully request to amend into the present application the following paragraph [0041A]. Applicants respectfully submit that this paragraph does not constitute or introduce new matter, but merely states explicitly that which was already known to those of ordinary skill in the art about the chemical composition and structure of DAIS 585 material.

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[0041A] The material referred to in the previous paragraph as DAIS 585 ionomer has been described in the open literature having to do with fuel cells as a material that is a sulfonated styrene/ethylene-butylene/styrene tri-block copolymer, and is related to a class of polymers exemplified by Kraton, available from Shell Chemical. The structure of DAIS 585 can be represented by the structure given immediately below, in which it is shown that styrene monomers (e.g., a vinyl benzene or an arylvinyl monomer) is sulfonated, at least in part, and there are present olefinic monomers, such as ethylene.



The structure shown above therefore is recognized to include at least partially sulfonated arylvinyl monomers (such as the sulfonated styrene). A process suitable for sulfonating the Kraton material is described in greater detail in U.S. Patent No. 5,468,574, at column 11, line 46, through column 13, line 2, which patent issued on November 21, 1995 and was assigned to the Dais Corporation.

Examiner Spitzer is thanked for a telephonic interview that took place on February 8, 2005, in which the undersigned participated. During the interview, agreement was reached that new paragraph [0041A] will be allowed to be amended into the Specification; and that the rejections of claims under 35 U.S.C. §112, second paragraph, is overcome by the presence of paragraph [0041A]. There was agreement that the arguments presented by the

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undersigned overcome the rejections of claims under 35 U.S.C. §102(b) and under 35 U.S.C. §103(a) because the primary reference relied upon is inapposite. The substance of the undersigned's argument is presented herein below. The Examiner suggested that Applicants copy verbatim those claims from United States Patent No. 6,413,298 that Applicants believe they are entitled to present. Accordingly, claims 1, 14, 15, 16, 21, 22, 24, 25, 30, 31, and 33, respectively, have been copied verbatim as claims 49-59.

Response to Rejection of Claims under 35 U.S.C. §112, 2nd Paragraph

Claims 38, 39, 42, 43, 46, and 47 were rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. In particular, the Office action states that the specification does not contain any support for these limitations, in that there is no specific mention of either the hydrocarbon polymer comprising "at least one arylvinyl monomer" or that such monomer "is at least partially sulfonated."

In the Specification as originally filed, paragraph [0042] as originally filed, recites in relevant part:

[0042] The sulfonated polymer membranes do not necessarily require a hydrocarbon or perfluorinated backbone chemical structure. Rather, the backbone could be a block or random copolymer. ... However, such block or random copolymer must have the ionic sulfonate group (SO₃). Additionally, the polymer membrane may be fully or partially sulfonated. Altering the degree of sulfonation affects the polymer membrane's ability to transfer moisture, and it is generally preferable to have a high degree of sulfonation within the polymer membrane. (emphasis added)

Thus, the application plainly teaches the use of either a random or a block copolymer having at least partial sulfonation.

To the extent that paragraph [0041A] is permitted to be amended into the specification, there is explicit support for "a water-conducting membrane ... comprising an at least partially sulfonated random hydrocarbon copolymer." Even if paragraph [0041A] is not

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permitted entry, the reference to DAIS 585 material, in light of the teachings of a number of publications printed in 1995-1998 and discussed herein, is sufficient to put one of ordinary skill on notice as to what is connoted by the statement “a water-conducting membrane ... comprising an at least partially sulfonated random hydrocarbon copolymer.” Applicants respectfully submit that, whether or not proposed paragraph [0041A] is amended into the Specification, one of ordinary skill at the time of the filing of the earliest application to which priority is claimed, namely US Provisional Patent Application Serial No. 60/158,533, filed October 8 1999, would have been on notice as to the chemical composition and structure of the DAIS 585 material. Accordingly, Applicants respectfully submit that the requirements of 35 U.S.C. §112, 2nd Paragraph have been fully satisfied.

Response to Rejection of Claims under 35 U.S.C. §102(b)

Claims 37, 40, 41, 44, 45, and 48 were rejected under 35 U.S.C. §102(b) as being anticipated by Yamada. Yamada teaches membranes that comprise hydrocarbon-based polymers and the use of such membranes in an air conditioning system. At column 5, lines 42-43, Yamada explicitly teaches “and other polymers such as polyether sulfone, polysulfone, polypyromellitimide, ...” (emphasis added) Nowhere does Yamada teach or suggest the use of a sulfonated polymer. Nowhere does Yamada teach or suggest a random polymer. Indeed, an automated search of the text of Yamada on the USPTO website fails to return even one instance of the terms “random,” “sulfonate,” or “sulfonated” anywhere in the published patent.

A sulfone is chemically different from, and is distinguishable from, a sulfonate.

Applicants append hereto a page from the Encyclopedia Britannica web site, <http://www.britannica.com/eb/article?tocId=9070244>, that defines sulfone as “any of a family of organic sulfur compounds in which two carbon-containing groups are linked to the group SO₂. The best known members of the family are the polysulfone (q.v.) resins and several drugs used in the treatment of leprosy.” In other words, a sulfone is a compound in which an SO₂ group acts to connect two molecular units, by bonding to two carbon atoms, one in each molecular unit. Applicants also present two examples: divinyl sulfone, as shown in the web page http://www.wuzhouchem.com/cataloged/inte/dinyl_sulfone.htm, a copy of which is

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appended hereto, in which two vinyl groups are connected by the sulfur atom of a sulfone (SO_2) group; and the Hinsberg sulfone synthesis, in which a sulfone comprising two aromatic moieties are connected by the sulfur atom attaching to each of two carbons in different benzene rings, which benzene rings carry additional substituents for the normal hydrogens of benzene, as shown at the web page.

http://thermerckindex.cambridgesoft.com/TheMerckIndex/Name_reactions/ONR187.htm, a copy of which is appended hereto, which synthesis has been known since the 19th century.

In contradistinction, as exemplified in the structure of sulfonated Kraton already described hereinabove, a sulfonate is a molecule in which a SO_3 moiety is attached in a terminal relation to a carbon atom of a hydrocarbon molecule. The sulfonate lacks a second sulfur-carbon bond found in a sulfone. As is well known in the chemical arts, a difference in chemical composition by as little as one atom, or one chemical bond, is sufficient in many instances to impart radically different properties, and in many instances, unpredictably different properties, to the modified chemical substance as compared to the unmodified substance. Therefore, because Yamada fails to teach or suggest any hydrocarbon-based polymer that is sulfonated, and Yamada additionally fails to teach or suggest any randomly bonded hydrocarbon-based polymers, Yamada cannot teach or suggest "disposing a water-conducting membrane between said first and second stream, said water-conducting membrane having at least two opposed surfaces and comprising an at least partially sulfonated random hydrocarbon copolymer." Since independent claims 37, 41 and 45 all include as a limitation a membrane "comprising an at least partially sulfonated random hydrocarbon copolymer," Applicants respectfully traverse the rejection of claims 37, 40, 41, 44, 45, and 48 as being anticipated by Yamada. Applicants respectfully submit that independent claims 37, 41, and 45 are allowable, and that claims 38-40, 42-44 and 46-48 which depend from allowable base claims 37, 41 and 45, respectively, are also allowable because they include every limitation of any claim from which they depend. (See 35 USC §112, 4th Paragraph.)

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Response to Rejection of Claims under 35 U.S.C. §103(a)

Claims 38, 39, 42, 43, 46, and 47 were rejected under 35 U.S.C. §103(a) as being unpatentable over Yamada in view of U.S. Patent No. 5,620,500 to Fukui et al. (hereinafter "Fukui"). The Examiner has a burden of demonstrating that there exists a motivation, suggestion, or teaching to combine the teachings of two or more patents, which motivation, suggestion, or teaching must be found independent from the teachings of the application being examined. See *In re Werner Kotzab*, 217 F.3d 1365 (CAFC; 2000).

The CAFC stated in *Kotzab* at pages 1369-70 (citations omitted):

Most if not all inventions arise from a combination of old elements. Thus, every element of a claimed invention may often be found in the prior art. However, identification in the prior art of each individual part claimed is insufficient to defeat patentability of the whole claimed invention. Rather, to establish obviousness based on a combination of the elements disclosed in the prior art, there must be some motivation, suggestion or teaching of the desirability of making the specific combination that was made by the applicant. Even when obviousness is based on a single prior art reference, there must be a showing of a suggestion or motivation to modify the teachings of that reference.

The motivation, suggestion or teaching may come explicitly from statements in the prior art, the knowledge of one of ordinary skill in the art, or, in some cases the nature of the problem to be solved. In addition, the teaching, motivation or suggestion may be implicit from the prior art as a whole, rather than expressly stated in the references. The test for an implicit showing is what the combined teachings, knowledge of one of ordinary skill in the art, and the nature of the problem to be solved as a whole would have suggested to those of ordinary skill in the art. Whether the Board relies on an express or an implicit showing, it must provide particular findings related thereto. Broad conclusory statements standing alone are not "evidence."

Fukui teaches membranes comprising fluorocarbon-based polymers that are sulfonated for use in air conditioning systems. Nowhere does Fukui teach or suggest a hydrocarbon polymer or a random polymer as a membrane that is permselective for water vapor. Indeed, an automated search of the text of Fukui on the USPTO website fails to return even one instance of the terms "random" or "hydrocarbon" anywhere in the published patent. Fukui does teach various hydrocarbon materials as a porous substrate for the sulfonated fluorocarbon-based polymers that are the permselective material.

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As indicated at paragraphs [0040] through [0042] of the present application, there are distinct chemical differences between hydrocarbon-based polymers and fluorocarbon-based polymers. As already described hereinabove, there are also explicit chemical differences between sulfones and sulfonates. The Examiner has not presented a motivation, suggestion, or teaching for combining the chemical teachings of one reference that describes hydrocarbon-based sulfone polymers and another reference that describes fluorocarbon-based sulfonated polymers. Even if such a motivation did exist, which Applicants do not concede, neither Yamada nor Fukui teaches or suggests a random copolymer. Accordingly, neither Yamada nor Fukui, whether taken alone or together, can teach or suggest "disposing a water-conducting membrane between said first and second stream, said water-conducting membrane having at least two opposed surfaces and comprising an at least partially sulfonated random hydrocarbon copolymer."

35 USC §112, 4th paragraph, explicitly states that

Subject to the following paragraph, a claim in dependent form shall contain a reference to a claim previously set forth and then specify a further limitation of the subject matter claimed. A claim in dependent form shall be construed to incorporate by reference all the limitations of the claim to which it refers;

Claims 38 and 39 depend from independent claim 37, claims 42 and 43 depend from independent claim 41, and claims 46 and 47 depend from independent claim 45. Therefore, the limitation of a membrane "comprising an at least partially sulfonated random hydrocarbon copolymer" is present in every one of claims 38, 39, 42, 43, 46 and 47. At least for the reason that neither Yamada nor Fukui describes a random copolymer, neither Yamada nor Fukui, taken alone, or combined (the appropriateness of which Applicants do not concede) can possibly teach or suggest all of the limitation of a membrane "comprising an at least partially sulfonated random hydrocarbon copolymer." Accordingly, Applicants respectfully question the appropriateness of the rejection under 35 USC §103(a), and suggest that such rejection is not properly presented. In addition, should Applicants be in error as to the validity of the rejection under 35 USC §103(a), Applicants traverse the rejection because there is no teaching anywhere in Yamada or Fukui as to the use of a random copolymer. Applicants respectfully submit that claims 38, 39, 42, 43, 46 and 47 are allowable.

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**Argument Explaining the Literal Differences Between the New, Copied, Claims
and the Language of the Specification**

Applicants have previously explained, in the Preliminary Amendment filed contemporaneously with the filing of the present Application, why it is believed that the term "statistical" copolymer as used in newly added claims 49-59 includes the term "random" copolymer as used in the Specification of the present application and in the originally presented claims 37-48 of the present application. Applicants believe that the term "statistical copolymer" as used in United States Patent No. 6,413,298 specifically includes "random" copolymers. Attention is directed to United States Patent No. 6,413,298 at column 5, line 28, through column 6, line 52, which discusses block, graft, and statistical polymers or copolymers, as well as some of the chemical features of such polymers. The arguments presented in the Preliminary Amendment already filed in the present Application will not be repeated here.

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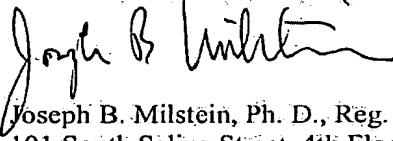
CONCLUSION

Applicants respectfully request that the application be reconsidered and that the rejections of Claims 37-48 be withdrawn. Applicants submit that Claims 37-48 and newly added Claims 49-59 are now in proper condition for allowance, and requests the issuance of a Notice of Allowance at the Examiner's earliest convenience. Applicants respectfully request that, in the event that any claim is deemed allowable, that the interference with United States Patent No. 6,413,298 requested at the time of filing the present application be declared.

If the Examiner believes that contact with Applicants' attorney would be advantageous toward the disposition of this case, the Examiner is requested to call Applicants' attorney at the phone number noted below.

Respectfully submitted,
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Date: February 22, 2005

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Customer No.: *20874*

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PATENT TRADEMARK OFFICE

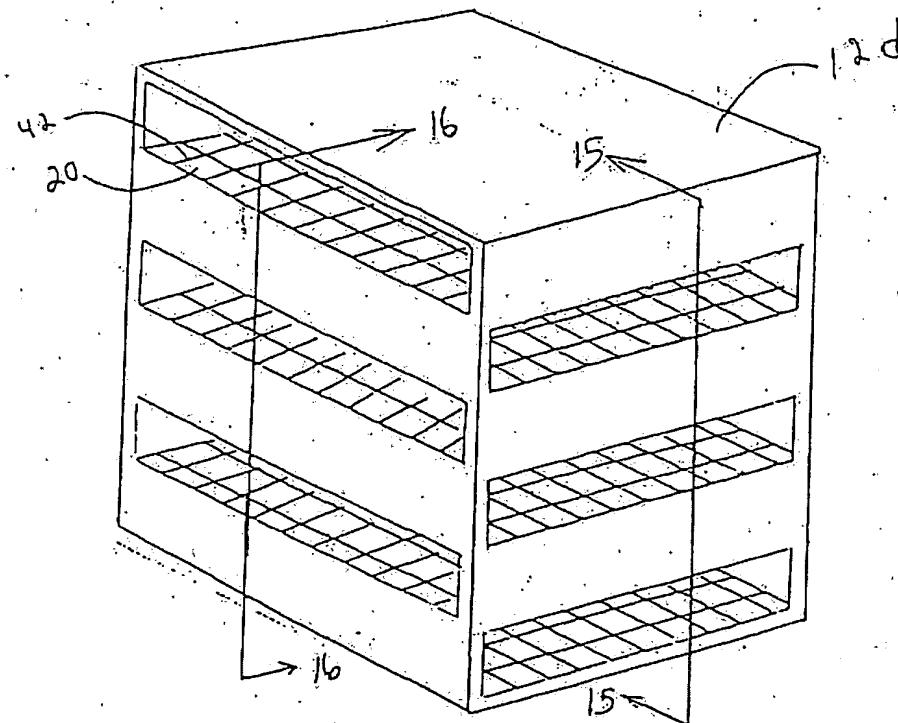


Fig. 14

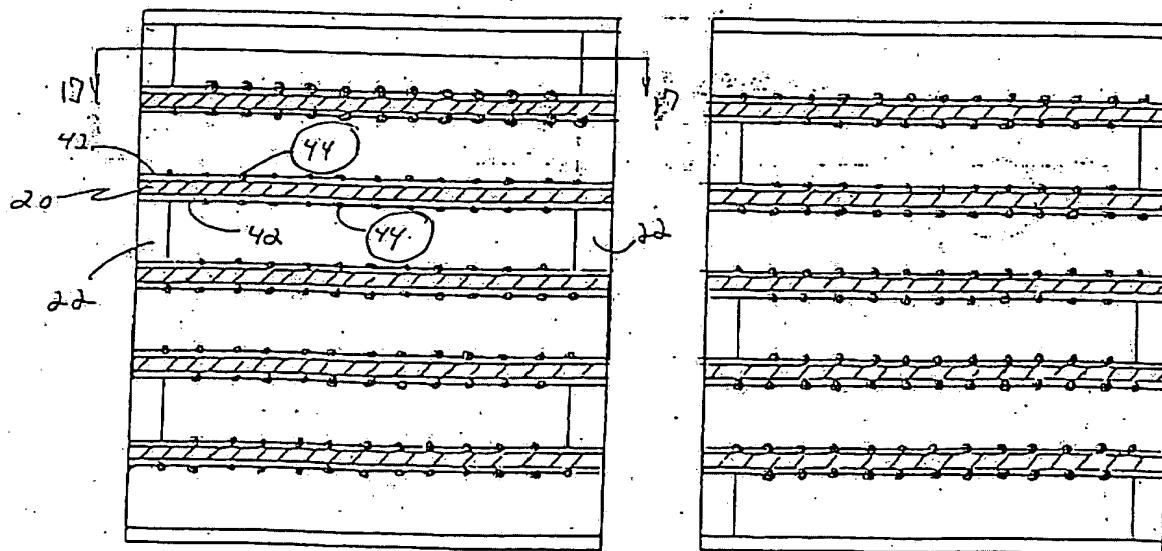


Fig. 15

Fig. 16